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THE ROLE OF CLIENTS/END-USERS IN INNOVATION OF STANDARDISED DETACHED HOUSES

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Intensified innovation has for long been discussed as a means to improve productivity and quality in construction. In recent years, user-driven innovation and clients as change agents have been promoted as drivers of innovation. In particular the concept of lead users by von Hippel has featured prominently as inspiration. Still, it is not particularly clear what role users can play in the development of construction. The standardised detached house segment is the market segment in the construction sector that is closest to the end-user as private families are both clients and residents of the house. This paper explores the interaction of innovation between companies selling standardised detached houses and end-users. Based on OECD's definition of innovation, the study applied a quantitative web-based survey of companies operating in the mass market for standardised detached houses. The main result of the study is that within the past three years, innovation of products has dominated, but companies have also to some extent made process, organisation and marketing innovations. The study also showed that the typical drivers of innovation are legal requirements, meeting customer demands and improving quality. The main sources of innovation are the employees of the companies along with private clients and the delivery system.

Keywords: client, industrialisation, user, user-driven innovation.

INTRODUCTION

There are large differences between conditions for individual building projects, and that has implications for the various actors' ability to plan and execute construction as well as their ability to be innovative. The construction trade as opposed to traditional industrial production is project-based. Consequently, the idea of industrialisation has been the target of innovation initiatives rather than a starting point for innovation, and increased industrialisation has long been seen as a way to increase productivity in the construction sector (Blismas, 2007).

Standardised detached houses is the market segment within construction that is closest to industrial production and at the same time closest to the end-user, as there is typically an overlap between the client and the end-user in the production of standardised detached houses. User-driven innovation has long been perceived as a new source of innovation, and in construction attention has also centred on the role that end-users could play in the development of construction.

This paper is based on a survey conducted among the companies of standardised detached houses in, 2008. The empirical study focuses on:

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- Who are the companies?
- Who are the users?
- What characterises the standardised detached house as a product?
- What type of innovation, drivers of innovation and source of innovation takes place within the industry of standardised detached houses?

In this paper some of the results from the survey are presented, and these are discussed with respect to what role the client and end-user can play in the innovation process of standardised detached houses.

THEORETICAL PERSPECTIVES

Innovation in project-based companies

Buildings consist of many products integrated in complex product systems. Furthermore, buildings are produced in complex design and production systems by project-based firms, who usually cooperate in one-off processes (Winch, 1998; Gann and Salter, 2000; Barrett and Sexton, 2006).

Innovation is generally considered a way to increase productivity in the construction industry (Barrett and Sexton, 2006). In recent years, services have emerged as a growing innovation area together with physical products. 'Services include financial deal structuring, planning and design, specialist consultancy, customer support and training, supply-chain coordination, production and risk management etc.' (Gann and Salter, 2000: 962).

The third edition of the Oslo Manual (OECD and Eurostat, 2005) describes four types of innovation: product, process, organisation and marketing. Further, it is stated that innovation within one area influences other areas and in that sense innovation will often occur in more than one area. Product innovation is the introduction of things or services that are new or significantly improved with respect to properties or intended use. Process innovation is the introduction of new significant production or delivery methods. Organisational innovation is the implementation of new organisational practices in the company's business practices, workplace organisation or external relations. Marketing innovation is the implementation of new marketing methods that involve changes in product design or packaging, product placement in the market or sales promotion or pricing.

User-driven innovation

Von Hippel has introduced the idea of lead users into innovation management theory. The central actors in this perspective are users and companies, and the focus centres on their interplay in the innovation process. Von Hippel (2005: 3) defines users as: 'firms or individual consumers that expect to benefit from using a product or service'. In this sense 'users' refers to existing users. In contrast, companies are defined as 'companies that expect to benefit from selling a product or a service' (von Hippel, 2005: 3). The motivation of the studies can be found in the assumption that traditional product developments can no longer satisfy users' needs. Furthermore, products often do not match needs and users have to compromise if they buy the products. On the other hand this is what motivates some users to innovate.

A central driver in user-driven innovation is the users' and the companies' asymmetric knowledge. Von Hippel (2005: 8) points out that 'product developers need two types of information in order to succeed at their work: need and context-of-use information

(generated by users) and generic solution information (often initially generated by companies specialising in a particular type of solution'. Users tend to be experts on knowledge about needs and context-of-use information, while the product developers tend to be experts on generic solution information. So the challenge for management is to find methods to bring these two knowledge bases together. Von Hippel (1986: 791) defines lead users as '.... users whose present strong needs will become general in a marketplace months or years in the future. Since lead users are familiar with conditions that lie in the future for most others, they can serve as a need-forecasting laboratory for marketing research. Moreover, since lead users often attempt to satisfy the need they experience, they can provide new product concept and design data as well.'

In this perspective, lead users are very important users and much attention has been paid to identify lead users and to find out under what circumstances companies and lead users can benefit from each other.

Users of standardised detached houses

Haugbølle and Forman (2006) suggested that users of standardised detached houses should be considered as multi-centred users. This means that users of standardised detached houses have multiple perspectives or focal points that are time-dependent in two ways: first they are coupled to the life-cycle of the building, second they are coupled to the life-cycle of the actor. However, from a functional point of view the one and same actor has to deal with at least three different roles rolled into one: that of a client, that of an owner and that of a customer.

First, as a client the user has to deal with not only the erection of the building but also continuous maintenance, repair work and re-building – some of which is even done as do-it-yourself (DIY) activities. Second, as an owner (or owner in the making) the user will have to consider issues related to financing often through mortgage loans, taxation schemes, and the potential sale of the building at some future date. As Ozaki (2003) pointed out in his study of home-builders in UK, the users already consider e.g. the sales price of a house when they purchase it. Clearly, the issue of financing is also a very important precondition for users to become users at all. In other words, if you cannot afford a house or if the mortgage institution is not willing to lend you the necessary sum of money, you will be deemed a non-user. Third, as a customer the user will address issues such as identity, security, neighbourliness etc. In a study of families living in older villas and in standard houses built since the 1970s, Bech-Danielsen and Gram-Hanssen (2004) demonstrated how residential neighbourhoods are associated with different symbolic values and how these values influence the choice of home.

Barrier to customer orientation

Ozaki (2003) mentioned a number of barriers that prevent companies from being customer-oriented. The industry is worried that private clients will not buy customised houses, because they want to buy houses that they can be sure of being able to sell again. There is therefore a need for some standardisation of houses around a consensus of what a good house is. The companies' possibilities to adjust to personal preferences are constrained by construction schedules. Building regulations have a major impact on construction and limits the possibilities for customisation. Ozaki (2003: 559) concluded that 'Clearly culture and attitudes of the industry and regulatory frameworks are factors that have to overcome in order to achieve more customer-focused housebuilding'.

METHODOLOGY

The methodology of the project has primarily involved a web-based survey of the Danish companies providing standardised detached houses in early, 2008. The procedure is described in detail below.

Mapping of potential respondents

The mapping of potential respondents took place by applying four methods. Firstly, the survey included a search of the CVR register for relevant companies as respondents. CVR is the Central Business Register, which contains all primary data on all public and private businesses. Secondly, the housing sections of the big morning dailies were checked for advertisements for standardised detached house companies and mentions of standardised detached houses over a 2-year period. Thirdly, the project participants reviewed or participated in three different housing exhibitions in Denmark. Fourthly, various internet search engines were used to identify potential respondents. Initially, the website for a trade organisation for companies selling standardised detached houses was reviewed for member companies. In parallel, a screening by google.dk was conducted. At that time, this gave more than, 20,000 hits for the search criterion 'standardised detached house'. It quickly became prohibitive to examine them all one by one. The searches were extended with various additional search criteria, and a large number of individual hits were examined manually. Moreover, the three search engines www.krak.dk, www.dgs.dk (Yellow Pages) and www.search.live.com were used to find potential respondents by searching for the string "standardised detached house".

This mapping resulted in a list of over 317 companies. Each of these companies was subsequently contacted by telephone to assess in more detail their relevance for the investigation and to find the relevant contact person for the web-based survey to ensure a higher response rate. In connection with this telephone contact, 65 companies were discarded, because they were deemed not relevant. In the course of carrying out the survey, another, 20 companies were discarded, because they responded that they were outside the target group. In this way, the relevant respondents were reduced from 317 companies to 232 companies in Denmark.

Design of questionnaire

The system SurveyXact was used to carry out the survey. SurveyXact is an internet-based application for administering questionnaire surveys. The program was developed by Ramboll Management. Using this program, you can create metrics, design questionnaires and distribute them to respondents. Afterwards, you can collect responses and analyse the responses.

The questionnaire itself was structured in 6 themes:

1. Business data
2. Products
3. Production conditions
4. Companies' interaction with the market
5. Innovation
6. Expectations for the future

The questionnaire went through several iterations over a one-year period before it was launched. The overall themes, the weight of each theme, the sequence of questions,

potential leaps among questions as well as the formulation of individual questions were repeatedly being debated and rephrased before the project team was satisfied with the structure of the questionnaire, the formulations of individual questions etc.

Carrying out the questionnaire survey

Contacting respondents

The survey was conducted as an anonymous survey. Respondents received an email with a link to the questionnaire. The questionnaire began with an introduction to the survey. In the introduction, the respondents could activate the questionnaire if they wanted to answer it. The answer could be opened throughout the survey period, which meant that each respondent could complete and edit their responses throughout the period. Reminders were sent three times to the respondents who had not activated the questionnaire or only partially answered the questionnaire.

Response rate

Table 1 shows the overall status of respondents in the survey. The completion rate was 24.1 %. A higher response rate would have been desirable, but as this was an internet-based survey, the response rates were considered reasonable.

Table 1: Response rate. Source: (Haugbølle and Forman, 2010).

Response	Respondents	Response rate
No answer	142	61.2 %
Some answer	34	14.7 %
Completed	56	24.1 %
Total	232	100 %

Representativeness

Based on two factors, it was estimated that the respondents were representative of the industry: size and number of new construction of standardised detached houses. In Denmark companies selling standardised detached houses vary between a few very large companies and a wide range of small companies. Respondents represented both very large companies and small companies. Danish statistics show that 8,490 standardised detached houses were completed in, 2006 in Denmark (Statistics Denmark BYGV3). In the survey, the number of newly built standardised detached houses was 1,785 in, 2007. Taking into account that the figures are from, 2006 and, 2007 respectively, the survey covered some 21 % of newly built standardised detached houses. Comparing this with the fact that 24.1 % of the respondents completed the survey and that respondents were selected according to the criterion that they produced standardised detached houses, the survey was considered to be representative.

Survey conditions might have been better

In designing a questionnaire, the challenge is always to clarify your problem as accurately as possible with the number of questions in the questionnaire. In hindsight, the investigation was too ambitious in the sense that the questionnaire was too long. Response time was 30-40 minutes and the response rate could very likely have been improved if it had been shorter. Table 1 shows that 14.7 % of respondents only responded to some questions. Some of these respondents might have completed the entire survey if it had been shorter.

EMPIRICAL RESULTS

Characteristics of companies

Organisation

The study showed that the structure was highly polarized, with many small companies with a modest turnover below DKK 50 million (EUR 7 million) per year and a few very large companies. Standardised detached house companies are predominantly Danish and with relatively few exporting companies, predominantly exporting to the neighbouring markets in Scandinavia and Germany.

Although the most common form of ownership is the limited liability company, limited companies and sole proprietorships are also popular forms of ownership among small companies. Other types of ownership are rarely seen.

The companies belong mainly to four sectors: 1) construction of buildings, 2) architectural firms, 3) companies providing prefabricated buildings or elements of wood, and 4) performing craft or construction companies.

Although the standardised detached house trade is characterised by a relatively stable inflow of new companies over time, the past decade, has however been characterised by a large influx of new companies. The majority of companies had not experienced organisational changes in the last five years, and few companies are planning organisational changes within the next three years.

It is interesting that in fact none of the respondents predicted the financial crisis, which came immediately after this investigation was completed. This was expressed by all respondents who expected stability or growth in the future.

Production

Production in the standardised detached house trade was characterised by emphasis on construction activities related to the standardised detached houses on site and not in the factory. The companies always, or often used, prefabricated components such as windows, doors and rafters that were purchased primarily by Danish companies.

The companies' dominant key functions were design, planning, marketing, sales of the finished house, construction management and carpentry/joinery. In contrast, plumbing, electrical and painting work, gardening and construction work, import and production of building components, were often done by subcontractors.

To a very high degree, the companies used the same partners or flexible partners, while only a very small percentage of supplier relationships were characterised by being new on every project.

Product

The products of the standardised detached house trade were characterised by the size of the houses, which ranged between 150 and, 200 m². With few exceptions, the estimated price per square meter for standardised detached houses was less than DDK 14,000 per m².

Most companies used either wood or concrete to support structures, and they frequently used facing wall as façade cladding.

A high degree of flexibility characterised most companies in relation to tasks and products. The majority of companies had a relatively broad portfolio of jobs besides standardised detached houses, which also covered low-dense buildings, commercial buildings, renovations and extensions. Furthermore, the majority of the companies

assessed that they were working on individual projects every time. Finally, companies indicated that the standardisation rate was relatively low. There were either no restrictions or opportunities for options on most parameters except for the load-carrying structures and façade covering.

Customers: clients and users

Results show that the typical customers for standardised detached houses were couples with or without children. Senior citizens were also a major target group for over half of the companies.

For standardised detached houses, the typical client was predominantly private consumers, while just under half of the companies even acted as clients. Construction projects repeated with the same private client also occurred, but to a lesser extent.

The customers participated always or often in the purchase of land, design and surrounding areas. Customer participation in the construction process was less frequent, when it came to engineering design, construction and outfitting.

The typical customer contact went through one contact, either with or without the opportunity to communicate directly with relevant professionals. The most commonly used methods for monitoring customer satisfaction was the personal follow-up after at least one year and by evaluating the inspections of building solutions after one year and five years respectively, both of which are statutory.

The companies estimated that the most important marketing method was the from-mouth-to-mouth method and the companies' own websites, closely followed by promotional material and billboards at the construction site. Traditional methods like television commercials, contests, advertisement in local newspapers etc. were regarded as less important.

The companies estimated that the principal competitive factors were product appearance, quality of materials and technical building technical aspects. These three parameters were followed by location, product flexibility and customer dialogue as three other important parameters of competition. Aspects concerning financial schemes and services are not considered competitive parameters.

Innovation

Companies innovate within the areas of products, processes, organisation and marketing, but innovation in the product area dominates. The top three areas - all within product innovation - that companies assess to be their main areas of innovation are in order of priority (for details, see Table 2):

- Design and plan solutions
- Energy
- Building materials

Within the other three types of innovations, a number of other innovations follow, but at a much lower level. These include:

- Process innovation: Construction process
- Marketing innovation: Customised products
- Organisational innovation: Client participation in the physical building process

Table 2: The companies' five most important innovation areas according to respondents (n=53). Source: (Haugbølle and Forman, 2010)

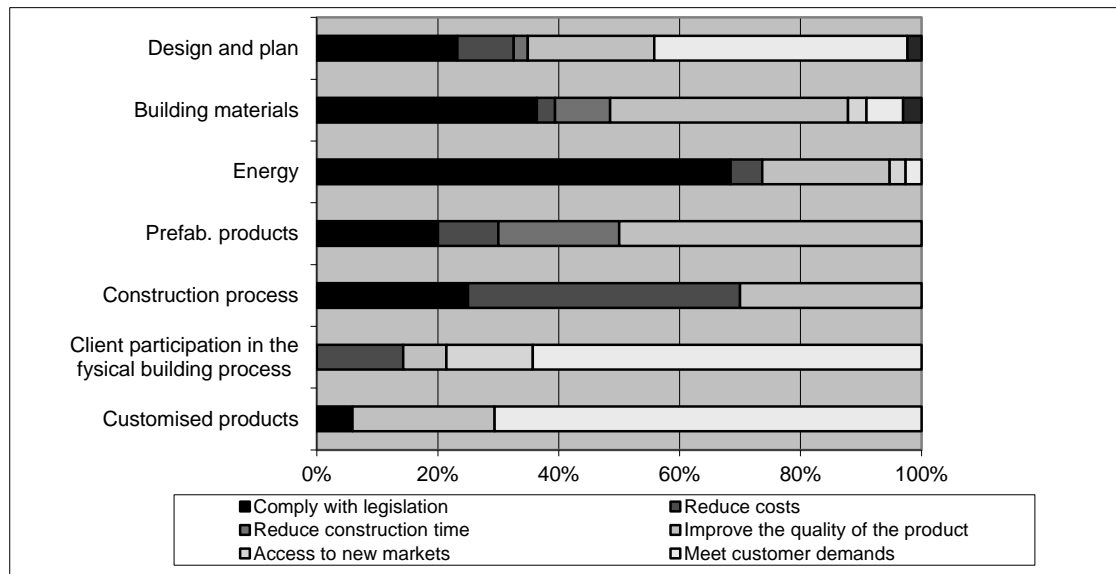
Type of innovation	Innovation	Response
Product	Design and plan	83 %
	Building materials	64 %
	Electricity and building services	11 %
	Interior	15 %
	Energy	72 %
	Outdoor areas	0 %
Process	Prefabricated products	19 %
	Construction process	38 %
	Construction site equipment such as machines, tools or roofing	4 %
Organisational	Internal change in the organisation	9 %
	Supplier relationships	17 %
	Mergers, buying, outsourcing, insourcing etc.	6 %
	Strategic cooperation with other companies	6 %
	Client participation in the physical building process	26 %
Market	Guarantee schemes	15 %
	New financial schemes	6 %
	Customised products	32 %
	Customer tools for designing the house or chose materials etc.	2 %

The typical drivers of innovation vary with the type of innovation. In sum, Table 3 illustrates that (see Table 3 for details):

- Statutory requirements are drivers in particular for new energy solutions.
- Meeting customer requirements is a driver when it comes to design and plan solutions, client participation in the physical building process and customised products.
- Improving quality is prominent when it comes to the development of construction materials and prefabricated products.
- Reducing costs will largely be a role for change in the construction process.
- Reduction of construction time, access to new markets and other aspects play a marginal role in driving innovation according to the respondents.
- Survey results regarding the drivers of innovation in companies suggested that the companies' own employees were the main sources of innovation. In addition, the private client and the delivery system in the form of consultants, subcontractors and component and material suppliers were assessed as important sources. Legislation, research and knowledge institutions as well as trade associations followed after. Competing companies were rarely mentioned as sources.
- Contact to innovation sources is defined in the OECD and Eurostat (2005) by the following three categories. 1) Open Information Resources and Information: Free information is available, which does not require trading technology or intellectual property rights or other interaction with the source. 2) Acquisition of knowledge and technology: Acquisition of external knowledge or technology (machinery, equipment and software, etc.) and

service that does not require interaction with the source. 3) Cooperation on Innovation: Active collaboration with external partners.

Table 3: Reasons for the company to innovate. Source: (Haugbølle and Forman, 2010)



The typical form of contact for innovation sources goes through open channels of information, and collaboration on innovation with particular customers and the delivery systems. However, the purchase of technology and/or knowledge was limited and in this case occurred primarily through advisors. The companies predominantly acquired knowledge and experience in conjunction with specific building projects. To a lesser degree, they obtained knowledge by collecting and evaluating cross-building projects and joint development work with the customer. Both qualitative and quantitative market surveys and other sources were used only modestly.

CONCLUSIONS

This paper has explored the relationship between companies producing detached standard houses and end-users with a particular focus on the users' role in innovation of standardised detached houses.

The study showed that the industry structure was highly polarised with a very few large companies and with many small companies with a modest turnover. The companies are mainly small project-based companies that focus on customisation of products in each building project rather than on innovation.

Further, the study has shown that companies do innovate within products, processes, organisation and marketing, but innovation on products dominates. The top three innovation types - all within product innovation - are design and plan solutions, energy and building materials. Within the other three types of innovations, a number of other innovations follow, but at a much lower level. These innovations include process innovations in the construction process, customised products and client participation in the physical building process.

Finally, the study has shown that the typical drivers of innovation are legal requirements, meeting customer demands and improving quality. The main sources of innovation are employees of the companies, private clients and the delivery system.

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